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Users Manual

CAL 3300 / 9300 / 9400 Autotune Temperature Controllers

English Français Deutsch Italiano Español

CAL Controls
Temperature Controllers

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INSTRUMENT PANEL FEATURES

! This page can be photocopied and used as a visual aid and bookmark when working in other parts of the manual.



Green Display: Process temperature or program **Function/Option**
Orange Display: Setpoint temperature or program **Option (9400 only)**
Green LED: Setpoint 1 output indicator
Red/Orange LED: Setpoint 2 output indicator

ADJUSTMENTS

To enter or exit **program mode**:	Press ▲ ▼ together for 3 seconds
To scroll through **functions**:	Press ▲ or ▼
To change **levels** or **options**:	Press ✶ ▲ together or ✶ ▼ together
To view setpoint:	Press ✶
To increase setpoint:	Press ✶ ▲ together
To decrease setpoint:	Press ✶ ▼ together
To reset an alarm or fault condition:	Press ▲ ▼ together briefly

Notes: If in difficulty by becoming "lost" in program mode, press ▲ and ▼ together for 3 seconds to return to display mode, check the INSTRUMENT ADJUSTMENTS above and try again.

When in program mode, after 60 seconds of key inactivity the display will revert to either ***inPt : nonE*** or, if the initial configuration has been completed, the measured value. Any settings already completed will be retained.

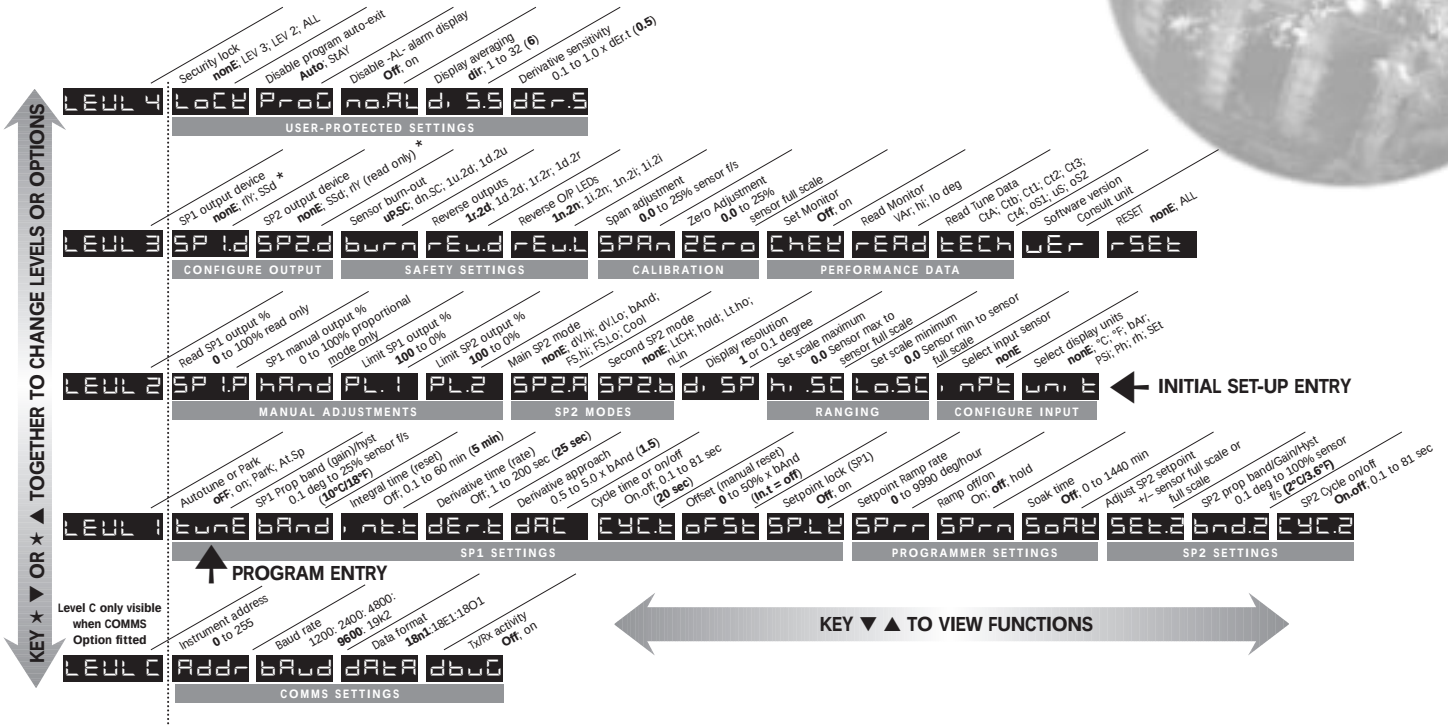
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FUNCTIONS MENU

This page can be photocopied and used as a visual aid and bookmark when working in other parts of the manual.

Range of Adjustment shown under description.
If applicable, factory settings shown in **bold**.

Note: The letter K appears in the instrument display as the character ㄴ



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GETTING STARTED

After power-up the controller requires programming with the following information:

Type of Sensor (See list of temperature sensors p.11)

Operating unit (See list of units p.8)

Allocation of Output Device to SP1/SP2 (Relay or SSd)

Temperature Setpoint

When the above information has been programmed into the controller it will be operational with the following factory settings.

Proportional band/Gain	10ºC/18ºF
Integral time/Reset	5 mins
Derivative time/Rate	25 secs
Proportional cycle-time (Typical setting for relay output)	20 secs
DAC Derivative approach control (Average setting for minimum overshoot)	1.5

The instruments covered in this manual may be fitted with either a single or a dual display. Where a single display shows more than one reading, it will alternate between them.

INITIAL SET-UP

On power-up the controller will display the self test sequence followed by the initial display ***inPt : nonE***

1 Select input sensor.

Press and hold ✶ and use the ▲ or ▼ buttons to scroll through the sensor selection list until the correct sensor is displayed. Release the buttons. The display will now read selected sensor type e.g. ***inPt : tCs***

Press ▲ once The display will now read ***unit : nonE***

2 Select unit.

Press and hold ✶ and use the ▲ or ▼ buttons to scroll through the unit selection list until the correct unit is displayed. Release the buttons. The display will read selected unit e.g. ***unit : °C***

Press ▲ once The display will now read ***SP1.d : nonE***

3 Select SP1 (Main setpoint output device)

Note: Dual Relay and Dual SSd Output Options Models have their outputs pre-configured. Move to Step 4.

Press and hold ✶ and use the ▲ or ▼ buttons to select ***SSd*** or ***rLY*** as required. The controller will now read selected output device e.g. ***SP1.d : SSd***

4 To enter initial configuration into controller memory

Press and hold both ▲ and ▼ buttons for 3 seconds. The display will now read ***ParK*** and measured variable (temperature) (eg. ***23***) ***ParK*** is displayed because a setpoint has not yet been entered.

To display setpoint
Press and hold ✶ The displays will now read ***unit*** (eg. ***°C***) and ***0***

To enter setpoint
Press and hold ✶ and use ▲ button to increase or ▼ button to decrease the reading and scroll to required setpoint value. (The digit roll-over rate increases with time).

THE CONTROLLER IS NOW OPERATIONAL WITH FACTORY SETTINGS

Note: For precise control of an application the controller may need to be TUNED. Please see the following section on AUTOTUNE

AUTOTUNE

This is a single shot procedure to match the controller to the process. Select either **Tune** or **Tune at Setpoint** from the criteria given below.

The **Tune** program should be used when the load temperature is at or near ambient. The procedure will apply disturbances when the temperature reaches 75% of the setpoint value, causing overshoot which is monitored in order to adjust the **DAC** overshoot inhibit feature. Care should be taken to ensure that any overshoot is safe for the process.

The **Tune at Setpoint** program is recommended when:

- The process is already at setpoint and control is poor
- The setpoint is less than 100°C
- Re-tuning after a large setpoint change
- Tuning multi-zone and/or heat-cool applications.

Notes: **DAC** is not re-adjusted by Tune at setpoint.
Proportional Cycle Time can be pre-selected before running the Autotune program. (see p5)

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Hereafter in the Manual the symbol (▲▼) signifies both buttons are held pressed for 3 seconds to ENTER or EXIT Program mode.

TUNE OR TUNE AT SETPOINT PROGRAM

Enter program (▲▼) and from the display ***tunE : oFF*** press and hold ✶ and press ▲ to display ***tunE : on*** or ***tunE : At.SP*** Exit program mode (▲▼).

The **TUNE** program will now start. The display will show ***tunE*** as the process temperature climbs to setpoint.

Note: During tuning, the main setpoint (SP1) LED will flash.

When the **TUNE** or **TUNE AT SETPOINT** program is complete the PID values are entered automatically. The process temperature will rise to setpoint and control should be stable. If not, this may be because optimum cycle time is not automatically implemented. To set the cycle time see **PROPORTIONAL CYCLE-TIME**.

PROPORTIONAL CYCLE-TIME

The choice of cycle-time is influenced by the external switching device or load. eg. contactor, SSR, valve. A setting that is too long for the process will cause oscillation and a setting that is too short will cause unnecessary wear to an electro-mechanical switching device.

Factory set
To use the 20 sec factory set cycle-time no action is needed whether autotune is used or not.

To Manually Select AUTOTUNE Calculated CYCLE-TIME
When AUTOTUNE is completed, enter program (▲▼) and select ***CYC.t*** in **Level 1**. The display will read ***CYC.t : 20*** (the factory setting).

To view the new calculated optimum value, press and hold both ✶ and ▼ buttons until indexing stops. The calculated value will be displayed eg. ***A16***. If acceptable, exit program (▲▼) to implement this setting.

To Pre-select Automatic Acceptance of AUTOTUNE Calculated CYCLE-TIME
Before AUTOTUNE is initiated select ***CYC.t*** in **Level1**, press and hold both ✶ and ▼ buttons until indexing stops at ***A _ _***. Exit program (▲▼) to accept calculated value automatically.

To Manually Pre-select Preferred CYCLE-TIME
Before AUTOTUNE is initiated select ***CYC.t*** in **Level 1**, press and hold both ✶ and ▲ or ▼ buttons until indexing stops at preferred value then exit program (▲▼) to accept.

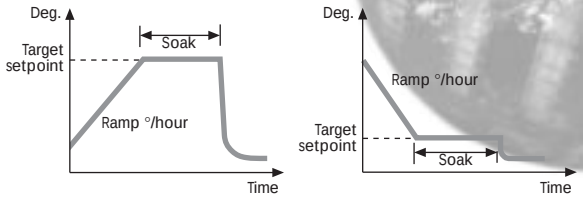
CYCLE-TIME RECOMMENDATIONS

Output Device	Factory Setting	Recommended Minimum
Internal relay: rLY/rLY1/rLY2	20 seconds	10 seconds
Solid state drives: SSd/SSd1/SSd2	20 seconds	0.1 seconds

PROGRAMMER

RAMP-SOAK

This feature enables the controller to ramp up or down from current temperature to a target setpoint at a pre-determined rate. It then controls at the target setpoint for an adjustable soak period before switching off the SP1 output.



Set **Setpoint ramp rate (**0 to 9995 deg/hour)

From ***SPrr*** in Level 1, press and hold ✶ and ▲ or ▼ to scroll to required ramp rate.

Set **Soak** (if required) 0 to 1440 minutes

From ***SoAk _ _*** in Level 1, press and hold ✶ and ▲ or ▼ to scroll to required Soak time.

Set **Ramp on** (Off: On: Hold)

From ***Sprn*** in Level 1, press and hold ✶, then press ▲ to select ***On***

Exit program (▲▼) to enter settings into memory and commence ramp to target setpoint.

Notes: In **Ramp on** configuration, if power is removed from the controller, the Ramp will re-start when power is restored.

The **Ramp hold** option suspends the ramp at its last value.

If no **Soak** period has been set, control at target setpoint continues indefinitely.

SP2 deviation alarms follow the ramp setpoint and can be used to alarm "out of limits" ramp rate.

WARNING
The Soak timer is triggered when the ramp setpoint reaches the target setpoint. If the ramp rate is set too fast for the process, the Soak timer will be triggered before the process temperature reaches the target setpoint.

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SECOND SETPOINT (SP2)

SECOND SETPOINT (SP2) Alarm Output

Configure SP2 output to operate as an alarm from ***SP2.A*** in Level 2 and set the temperature alarm setting in ***SEt.2*** Level 1. The alarm will be triggered when the process temperature changes according to the options listed below.

dV.hi Rises above the main setpoint by the value inserted at ***SEt.2***.

dV.Lo Falls below the main setpoint by the value inserted at ***SEt.2***.

BAnd Rises above or falls below the main setpoint by the value inserted at ***SEt.2***.

FS.hi Rises above the main setpoint by a ***SEt.2*** value that is greater than the setpoint.

FS.Lo Falls below the main setpoint by a ***SEt.2*** value that is smaller than the setpoint.

SUBSIDIARY SP2 MODE

The following additional alarm functions can be added to the above alarm configurations using the features found in **SP2.b** in Level 2.

LtCh Once activated, the alarms will latch and can be manually reset when the alarm condition has been removed.

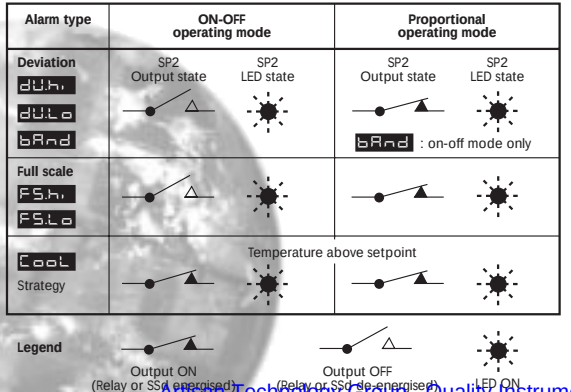
Hold This prevents any alarm operation on power-up and is automatically disabled once the process reaches setpoint in order to allow normal alarm operation.

SECOND SETPOINT (SP2) Proportional control output

Configure in **Level 1** using ***CyC.2*** to select proportional cycle time and ***bnd.2*** to adjust proportioning band. For Heat/Cool operation see Operating Manual.

In on/off mode, bnd.2 adjusts SP2 hysterisis.

SP2 OUTPUT AND LED INDICATION STATES - IN ALARM CONDITION



SP2 ALARM ANNUNCIATOR

When an SP2 alarm mode is selected in SP2.A the alarm annunciator ***-AL-*** is displayed, alternating with the process temperature, during alarm condition.

Notes: The alarm will be automatically reset when the temperature returns within the ***bnd.2*** setting in Level 1.
The annunciator may be disabled by selecting function ***no.AL : on*** in level 4.

SP2 in cool strategy

See Full Operating Manual (ADVANCED SETTINGS)

ERROR MESSAGES

SENSOR FAULT

Display flashes: ***inPt: FAiL***
Indicates: thermocouple burnout RTD/Pt100 open or short circuit or negative over-range.
Action: Check sensor/wiring

NON-VOLATILE MEMORY ERROR

Display flashes: ***dAtA : FAiL***
Action: De-power briefly. Replace unit if problem persists

MANUAL POWER ERROR

Display flashes: ***hAnd : FAiL***
SP1 set to ON/OFF in ***CYC.t***
Action: Select proportional mode

IMMEDIATE FAIL ON AUTOTUNE START

Display flashes: ***tunE : FAiL***
Setpoint display 0
1. No setpoint entered.
Action: Enter setpoint
2. SP1 set to ON/OFF in ***CyC.t***
Action: Select proportional mode

Note: To reset and clear error press ▲▼ together briefly to cancel message.

FAIL LATER DURING AUTOTUNE CYCLE

The thermal characteristics of the load exceed the Autotune algorithm limits. The failure point indicated by any display 0.0 in ***tech*** e.g. Ctb = 0.0

Action:
1. Change the conditions. eg. raise setpoint
2. Try ***tunE : At.SP***
3. If the error message persists, call local CAL representative for advice.

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FUNCTION LIST (LEVELS 1 TO 4)

Note: A Functions Menu is shown on page 3.

LEVEL 1 LEUL 1

Function **Options** *[Factory settings] shown in brackets*

SELECT AUTOTUNE (see pages 4/5)

tunE [oFF] ***on ParK At.Sp***

Used to switch the Autotune feature on and off, to select ***ParK*** or Autotune at setpoint. ***ParK*** temporarily turns the output(s) off. To use select ***ParK*** and exit program mode. To disable re-enter program at ***tunE*** and select ***oFF***.

SP1 OPERATING PARAMETERS

bAnD ***0.1 to * C/°F*** *[10°C/18°F]*
SP1 proportional band/Gain or Hysteresis
* 25% sensor maximum Proportional control eliminates the cycling of on-off control. Heater power is reduced, by time proportioning action, across the proportional band.

int.t oFF ***0.1 to 60 minutes*** *[5.0]*
SP1 integral time/reset
Auto-corrects proportional control offset error

dEr.t oFF ***1 - 200 seconds*** *[25]*
SP1 derivate time/rate
Suppresses overshoot and speeds response to disturbances

dAC 0.5 - 5.0 x bAnd *[1.5]*
SP1 derivative approach control dAC
Tunes warm-up characteristics, independent of normal operating conditions, by controlling when derivative action starts during warm-up (smaller dAC value = nearer setpoint).

CyC.t A _ _ on.oF ***0.1 - 81 sec*** *[20]*
SP1 proportional cycle-time (see pages 9/10)
Determines the cycle rate of the output device for proportional control. Select ***on.oF*** for ON/OFF mode.

oFSt [0] to * ***°C/°F***
SP1 offset/manual reset
* ±50% ***bAnd***. Applicable in proportional and ON/OFF mode with integral disable: ***Int.t : oFF***.

SP.LK [oFF] ***on***
Lock main setpoint
Locks the setpoint preventing unauthorised adjustment.

PROGRAMMER SETTINGS (see page 5)

Function **Options** *[Factory settings] shown in brackets*

SPrr ***[0] to 9995 deg/hour***
Sets the ramp rate

SPrn on [oFF] hoLd
Switches the ramp on or off, or hold at last ramp value

SoAK _ _ [oFF] ***0 to 1440 min***
Sets the soak time

SP2 OPERATING PARAMETERS (see page 6)

SEt.2 ***0 to * °C/°F*** *[0]*
Adjust SP2 setpoint
* Deviation Alarms ***DV.hi, DV.Lo, bAnd*** 25% sensor maximum.
* Full scale alarms ***FS.hi, FS.Lo*** sensor range f/s

bnd.2 ***0.1 - * °C/°F*** *[2.0 °C/3.6°F]*
Adjust SP2 hysteresis or proportional band/gain
(see ***CyC.2*** setting)
* 25% sensor f/s

CyC.2 [on.oFF] ***0.1–81 seconds***
Select SP2 ON/OFF or proportional cycle-time
Select on.oFF for ON/OFF mode, or the cycle rate of SP2 output device for proportional mode.

LEVEL 2 LEUL 2

MANUAL CONTROL MODES

SPI.P ***0 to 100 % 'read only'***
Read SP1 output percentage power

hAnd [oFF] ***1 to 100 % (not in ON/OFF)***
SP1 manual percentage power control
For manual control should a sensor fail. Record typical ***SP1.P*** values beforehand.

PL.1 ***100 to 0 % duty cycle*** *[100]*
Set SP1 power limit percentage
Limits maximum SP1 heating power during warm-up and in proportional band.

PL.2 ***100 to 0 % duty cycle*** *[100]*
Set SP2 percentage power limit (cooling)

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SP2 OPERATING MODES (see page 6)

Function **Options** *[Factory settings] shown in brackets*

SP2.A [nonE] ***dV.hi dV.Lo bAnd FS.hi FS.Lo Cool***
Main SP2 operating mode

SP2.b [nonE] ***LtCh hoLd nLin***
Subsidiary SP2 mode: latch/sequence
Non-linear cool proportional band

INPUT SELECTION AND RANGING

dI.SP [1] 0.1
Select display resolution: for display of process temperature, setpoint, ***OFSt, Set.2, hi.SC, LoSC***.

hi.SC **sensor minimum [sensor maximum]**
°C/°F
Set full scale

Lo.SC **[sensor minimum] sensor maximum**
°C/°F
Set scale minimum (default 0°C or 32°F)

inPt Select input sensor ***[nonE]***
(See **SENSOR SELECTION** table, page 11)

unit [nonE] ***°C °F bAr Psi Ph rh SEt***
Select °C/°F or process units

LEVEL 3 LEUL 3

OUTPUT CONFIGURATION

Note: 'Read only' after initial configuration. ***rSET ALL*** full reset to factory settings required to change ***SP1.d*** subsequently.

SP1.d [nonE] rLY SSd ***rLY1 rLY2 SSd1***
Select SP1 output device

SP2.d [nonE] SSd rLY ***rLY2 rLY1 SSd2***
Read SP2 output device
(read only)

Dual Relay and **Dual SSd** output options are factory set.
Note: (when in initial configuration only)Hold ✶ and ▲ or ▼ for 10 seconds to move to or from output devices in shaded portion.

burn **Sensor burn-out/break protection**
Caution: Settings affect fail safe state.

	SP1	SP2
[uP.SC]	Upscale	Upscale
dn.SC	Downscale	Downscale
1u.2d	Upscale	Downscale
1d.2u	Downscale	Upscale

rEu.d **Select output modes: Direct/Reverse**
Caution: Settings affect fail safe state.

	SP1	SP2
[1r.2d]	Reverse	Direct
1d.2d	Direct	Direct
1r.2r	Reverse	Reverse
1d.2r	Direct	Reverse

Select **Reverse** on SP1 for heating and **Direct** for cooling applications.

rEu.L **Select SP1/2 LED indicator modes**

	SP1	SP2
[1n.2n]	Normal	Normal
1i.2n	Invert	Normal
1n.2i	Normal	Invert
1i.2i	Invert	Invert

SPAn [0.0] to ±25% sensor maximum
Sensor span adjust
For recalibrating to align readings with another instrument e.g. External Meter, data logger. See Full Operating Manual (ADVANCED SETTINGS).

ZEro [0.0] to ±25% sensor f/s
Zero sensor error (see Sensor span adjust above).

ChEK [oFF] on
Select control accuracy monitor

rEAD [Var] hi Lo
Read control accuracy monitor

tECh [Ct A] CT b Ct 1 Ct 2 Ct 3 Ct 4 oS 1 uS oS 2
Read Autotune tuning cycle data (see Operating Manual)

UEr **Software version number**

rSET [nonE] ALL
Resets all functions to factory settings
Caution: This selection will lose all of the current settings.

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LEVEL 4 LEUL 4

Access to level 4 is gained through ***UEr*** in level 3. Press and hold ▲ and ▼ for 10 seconds.

Enter level 4 at ***Lock***, release ▲ and ▼ together. Display reads ***LoCK nonE***

Program security using Lock
Select from three ***Lock*** options: Press and hold ✶, press ▲ to index.

LEV.3	locks level 3 and 4 only- Technical Functions.
LEV.2	locks levels 2, 3 and 4 only - Configuration and Technical Functions.
ALL	locks all functions ***LoCK ALL***

Note: Locked functions and options may be read.

Press ▼ to access following functions

Function	**Options**	*[Factory settings] shown in brackets*
ProG [Auto]	***StAY***	

Program mode auto-exit switch
Auto-exit returns display to normal if 60 seconds of key inactivity, select ***StAY*** to disable

no.AL [oFF]	***on***	

Disable SP2 alarm annunciator -AL-
Select on to disable -AL-

di.SS dir	***1 to 32***	*[6]*

Display sensitivity
dir = direct display of input ***1*** = maximum, ***32*** = minimum sensitivity

dEr.S	***0.1 to 1.0***	*[0.5]*

Derivative sensitivity

MECHANICAL INSTALLATION

The Controllers are designed to be mounted either in a 1/16 or a 1/32 DIN panel cutout. The units are sleeve mounted with the front bezel assembly rated NEMA4/IP66 provided that:

- the panel is smooth and the panel cutout is accurate;
- the mounting instructions are carefully followed.

DIN PANEL CUTOUT

1/16 DIN: 45.0mm +0.6 / 0.0 wide, 45.0mm +0.6 / 0.0 high

1/32 DIN: 45.0mm +0.6 / -0 wide, 22.2mm +0.3 / -0 high

Maximum panel thickness 9.5mm

Minimum spacing 20mm vertical, 10mm horizontal

MOUNTING

To mount a Controller proceed as follows:

1 Check that the controller is correctly orientated and then slide the unit into the cutout.

2 Slide the panel clamp over the controller sleeve pressing it firmly against the panel until the controller is held firmly.

3 The controller front bezel and circuit board assembly can be unplugged from the sleeve. Grasp the bezel firmly by the recesses on each side and pull. A screwdriver can be used as a lever if required.

4 When refitting the bezel assembly it is important to press it firmly into the sleeve until the latch clicks in order to compress the gasket and seal to NEMA4X/IP66.

CLEANING

Wipe down with damp cloth (water only)

Note: The controller should be isolated before removing or refitting it in the sleeve, and electrostatic precautions should be observed when handling the controller outside the sleeve.

DIMENSIONS: MODELS 3300 / 9300 / 9400

Model	Bezel*		Behind Panel		Overall Length	Behind panel Length*
	Width	Height	Width	Height		
3300	51.0	28.5	44.8	22.0	116.2	106.7
9300	51.0	51.0	44.8	44.8	116.2	106.7
9400	51.0	51.0	44.8	44.8	116.2	106.7

Dimensions in mm
* includes gasket

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ELECTRICAL INSTALLATION

(See important Safety Information page 12)

OUTPUT DEVICES

Two of the following output devices are fitted to the controllers, depending on the model.

1 **Solid state relay drive (SSd/SSd1/SSd2)**
5Vdc +0/-15%, 15mA non isolating
To switch a remote SSR (or logic)
2 **Miniature power relay (rLY/rLY1)** 2A/250V AC resistive, Form A/SPST contacts.
3 **Sub miniature power relay (rLY2)** 1A/250V AC resistive, Form A/SPST contacts.

OUTPUT DEVICE ALLOCATION

Any of the available outputs may be chosen for the main setpoint (SP1), the remaining device being automatically allocated to the second setpoint (SP2).

Dual relay or dual SSd output models are available to order. Please contact your local CAL distributor for details.

Designed for use with the following supply voltages:

1). 100 - 240V 50-60 Hz 4.5 VA (nominal) +/-10% maximum permitted fluctuation

2). 12V - 24V (AC/DC) +/-20% 4.5 VA Polarity not required

WIRING THE CONNECTOR

Prepare the cable carefully, remove a maximum of 8mm insulation and ideally tin to avoid bridging. Prevent excessive cable strain. Maximum recommended wire size: 32/0.2mm 1.0mm^2 (18AWG).

INDUCTIVE LOADS

To prolong relay contact life and suppress interference it is recommended engineering practice to fit a snubber (0.1uf/100 ohms) between terminals 5 and 6.

CAUTION:

Snubber leakage current can cause some electro-mechanical devices to be held ON. Check with the manufacturers specifications.

EN61010 - /CSA 22.2 No 1010.1 92

Compliance shall not be impaired when fitted to the final installation.

Designed to offer a minimum of Basic Insulation only.

The body responsible for the installation is to ensure that supplementary insulation suitable for Installation Category II or III is achieved when fully installed.

To avoid possible hazards, accessible conductive parts of the final installation should be protectively earthed in accordance with EN6010 for Class 1 Equipment.

Output wiring should be within a Protectively Earthed cabinet.

Sensor sheaths should be bonded to protective earth or not be accessible.

Live parts should not be accessible without the use of a tool.

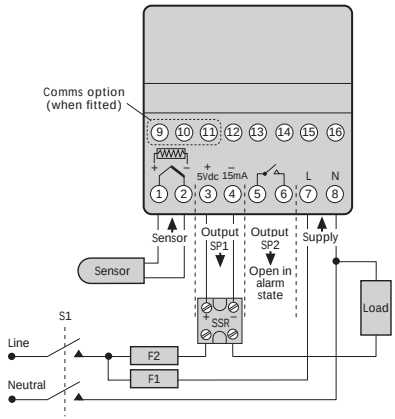
When fitted to the final installation, an IEC/CSA APPROVED disconnecting device should be used to disconnect both LINE and NEUTRAL conductors simultaneously.

A clear instruction shall be provided not to position the equipment so that it is difficult to operate the disconnecting device.

TYPICAL CONNECTION DIAGRAM

In this example the SSR driver output is allocated to SP1 and wired to switch the load (heater) using an SSR.

F1 Fuse: 1A time lag type to IEC127. CSA/UL rating 250Vac
F2 Fuse: High Rupture Capacity (HRC) Suitable for maximum rated load current
S1 Switch: IEC/CSA/UL Approved disconnecting device



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SENSOR SELECTION

Thermocouples	Description	Sensor range	Linearity
tC b	Pt-30%Rh/Pt-6%Rh	0 to 1800 °C	2.0 *
tC E	Chromel/Con	0 to 600 °C	0.5
tC J	Iron/Constantan	0 to 800 °C	0.5
tC K	Chromel/Alumel	-50 to 1200 °C	0.25*
tC L	Fe/Konst	0 to 800 °C	0.5
tC n	NiCrosil/NiSil	-50 to 1200 °C	0.25*
tC r	Pt-13%Rh/Pt	0 to 1600 °C	2.0*
tC s	Pt-10%Rh/Pt	0 to 1600 °C	2.0*
tC t	Copper/Con	-200 / 250 °C	0.25*
Resistance thermometer			
rtd	Pt100/RTD-2		0.25*

Linear process inputs (Input mV range: 0 to 50mV)

Displays	0 - 20mV	4 - 20mV	setpoint limits	
Lin1	0 - 100		0 - 400	± 0.5%
Lin2		0 - 100	-25 - 400	± 0.5%
Lin3	0 - 1000		0 - 3000	± 0.5%
Lin4		0 - 1000	-250 - 3000	± 0.5%
Lin5	0 - 2000		0 - 3000	± 0.5%

Notes: 1 Linearity: 5-95% sensor range
2 * Linearity B:5° (70º - 500°C) K/N:1° >350°C
exceptions: R/S: 5°<300°C T:1° <- -25° >150°C
RTD/Pt100: 0.5° <-100°C

SPECIFICATION

Thermocouple
9 types
Standards: IPTS/68/DIN 43710
CJC rejection: 20:1 (0.05°/°C) typical
External resistance: 100Ω maximum

Resistance thermometer
RTD-2/Pt100 2 wire
Standards: DIN 43760
(100Ω 0°C/138.5Ω 100°C Pt)
Bulb current: 0.2mA maximum

Linear process inputs
mV range: 0 to 50mV

Applicable to all inputs SM = sensor maximum

Calibration accuracy: ±0.25%SM ±1°C
Sampling frequency: input 10Hz, CJC 2 sec.
Common mode rejection: Negligible effect up to 140dB, 240V, 50-60Hz
Series mode rejection: 60dB, 50-60Hz
Temperature coefficient: 150ppm/°C SM
Reference conditions: 22°C ±2°C, rated voltage after 15 minutes settling time.

Output devices
SSd/SSd1/SSd2: solid state relay driver: To switch a remote SSR 5Vdc +0/-15% 15mA non-isolated
Miniature power relay: form A/SPST contacts (AgCdO)
rLY and rLY1: 2A/250ac resistive load
rLY2: 1A/250ac resistive load

General
Displays: Upper, 4 Digits, high brightness green LED. 10mm (0.4") high.
Lower, 4 Digits, Orange LED. 9mm (0.35") high (9400 only)
Digital range -199 to 9999
Hi-res mode -199.9 to 999.9
LED output indicators - flashing SP1 square, green; SP2 round, red
Keypad: 3 elastomeric buttons

Environmental
Humidity: Max 80%
Altitude: up to 2000M
Installation: Categories II and III
Pollution: Degree II
Protection: NEMA 4X, IP66
EMC emission: EN50081-1 FCC Rules 15 subpart J Class A
EMC immunity: EN50082-2
Ambient: 0-50ºC (32-130°F)
Mouldings: flame retardant polycarbonate
Weight: 130g (4.2 oz)

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SAFETY AND WARRANTY INFORMATION

INSTALLATION 

Designed for use:
UL873 - only in products where the acceptability is determined by Underwriters Laboratories Inc.
EN61010-1 / CSA 22.2 No 1010.1 - 92
To offer a minimum of Basic Insulation only.
Suitable for installation within Catagory II and III and Pollution Degree 2.

SEE ELECTRICAL INSTALLATION Page 10

It is the responsibility of the installation engineer to ensure this equipment is installed as specified in this manual and is in compliance with appropriate wiring regulations.

CONFIGURATION

All functions are front selectable, it is the responsibility of the installing engineer to ensure that the configuration is safe. Use the program lock to protect critical functions from tampering.

ULTIMATE SAFETY ALARMS

Do not use SP2 as the sole alarm where personal injury or damage may be caused by equipment failure.

WARRANTY

CAL Controls warrant this product free from defect in workmanship and materials for three (3) years from date of purchase.

1 Should the unit malfunction, return it to the factory. If defective it will be repaired or replaced at no charge.
2 There are no user-servisable parts in this unit. This warranty is void if the unit shows evidence of being tampered with or subjected to excessive heat, moisture, corrosion or other misuse.
3 Components which wear, or damage with misuse, are excluded e.g. relays.
4 CAL Controls shall not be responsible for any damage or losses however caused, which may be experienced as a result of the installation or use of this product.
CAL Controls liability for any breach of this agreement shall not exceed the purchase price paid E. & O.E.

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